Course Code: CSE 215		CIE Marks: 60
Course Title: Electronic Devices and Circuits		SEE Marks: 40
Credits: 3	Weekly: 2.5 Hours	Total Week: 16

Course Content (from syllabus):

Semiconductor, Bonds in Semiconductors, commonly used Semiconductors, Energy Band, Hole Current, Intrinsic and Extrinsic Semiconductor. N-type and P-type semiconductor, majority and minority carrier, PN junction, properties of PN junction. Biasing a PN junction, Volt-ampere characteristics of PN junction, limitation in the operation of PN junction Semiconductor diode, Equivalent circuit of crystal diode, Half wave rectifier, output frequency and efficiency of half wave rectifier, mathematical problems. Full wave rectifier, Centre-tap full wave rectifier, Full wave bridge rectifier, output frequency and efficiency of full wave rectifier, Mathematical problems, Comparison of rectifier circuits, filter circuits, types of filter circuits. Voltage stabilization, Zener diode, Equivalent circuit, Zener diode as a voltage stabilizer, Solving Zener diode problem, mathematical problems. Transistor, naming of transistor terminals, important facts about transistor, transistor action, transistor symbol, Transistor as an amplifier, mathematical problems. Transistor connection, common base connection, Mathematical problems, V-I characteristics of CB connection. Common Emitter connection, Mathematical problems, V-I characteristics of CE connection, Common collector connection, V-I characteristics of CC connection, comparison of transistor connection. Field Effect Transistors (FET), Types of FET, JEFT, Principle and Working of JFET, Schematic symbol of JFET, Importance of JFET, Difference between BJT and JFET, Output Characteristics of JFET, Important Terms, Expression for Drain Current (ID), Mathematical problems, Advantages of JFET. MOSFET, Types and Characteristics curve of MOSFET, Biasing of MOSFET and related problems. Faithful amplification, Transistor biasing, Methods of transistor biasing, Base resistor methods, Voltage divider biased methods, Single stage Transistor Amplifier, Practical circuit of transistor amplifier, Multistage Transistor amplifier, Role of capacitors in transistor amplifier, Amplifier with negative feedback., Principle of negative feedback amplifier, Gain of Negative voltage Feedback amplifier, Mathematical problems Sinusoidal Oscillation, Types of sinusoidal oscillation, Oscillatory circuits, Colpitt's Oscillator, Hartley Oscillator, Mathematical problems Introduction of OP-AMP, OP-AMP symbol, Polarity convention, Ideal OP-AMP characteristics, Virtual grounds and summing points, OP-AMP applications.

Course Description/Rationale:

This subject is classified under the applied technology group and is strongly intended to teach the students the concepts, principles and working of basic electronic components and their implementations on circuits. It is targeted to provide a basic foundation for technology areas like electronics devices, communication systems, industrial electronics as well as instrumentation, control systems and various electronic circuit design.

Course objective:

- To be able to understand the basics of electronic devices like diode, Transistor, MOSFET etc and their applications.
- To be able to differentiate between the working principal of different electronic components.
- To become skilled at designing different electronic circuits like rectifier, amplifiers etc.
- To apply theoretical knowledge for solving complex mathematical problems.

Course Learning Outcome (CO): (at the end of the course, students will be able to:)

CO1	**Recall** different basic electronics terms and devices those are the basic building blocks of electronic circuits.
CO2	**Demonstrate** the semiconductor physics, construction and operation of basic electronics devices.
CO3	**Analyze** any complex circuit network to find the required solution for professionals.

Content of the course:

Week	Course Content (as summary)	Hrs	COs
1	Semiconductor, Bonds in Semiconductors, commonly used Semiconductors, Energy Band, Hole Current, Intrinsic and Extrinsic Semiconductor. N-type and P-type semiconductor, majority and minority carrier, PN junction, properties of PN junction.	2.5	CO1, CO2
2	Biasing a PN junction, Volt-ampere characteristics of PN junction, limitation in the operation of PN junction Semiconductor diode, Equivalent circuit of crystal diode, Half wave rectifier, output frequency and efficiency of half wave rectifier, mathematical problems.	2.5	CO1, CO2, CO3
3	Full wave rectifier, Centre-tap full wave rectifier, Full wave bridge rectifier, output frequency and efficiency of full wave rectifier, Mathematical problems, Comparison of rectifier circuits, filter circuits, types of filter circuits	2.5	CO1, CO2, CO3
4	Voltage stabilization, Zener diode, Equivalent circuit, Zener diode as a voltage stabilizer, Solving Zener diode problem, mathematical problems	2.5	CO1, CO2, CO3
5	Transistor, naming of transistor terminals, important facts about transistor, transistor action, transistor symbol, Transistor as an amplifier, mathematical problems	2.5	CO1, CO2, CO3
6	Transistor connection, common base connection, Mathematical problems, V-I characteristics of CB connection	2.5	CO1, CO2, CO3

7	Common Emitter connection, Mathematical problems, V-I characteristics of CE connection	2.5	CO1, CO2, CO3
8	Common collector connection, V-I characteristics of CC connection, comparison of transistor connection	2.5	CO1, CO2, CO3
9	Field Effect Transistors (FET), Types of FET, JEFT, Principle and Working of JFET, Schematic symbol of JFET, Importance of JFET, Difference between BJT and JFET, Output Characteristics of JFET, Important Terms, Expression for Drain Current (I_D), Mathematical problems, Advantages of JFET	2.5	CO1, CO2, CO3
10	MOSFET, Types and Characteristics curve of MOSFET, Biasing of MOSFET and related problems.	2.5	CO1, CO2, CO3
11	Faithful amplification, Transistor biasing, Methods of transistor biasing, Base resistor methods, Voltage divider biased methods	2.5	CO2, CO3
12	Single stage Transistor Amplifier, Practical circuit of transistor amplifier, Multistage Transistor amplifier, Role of capacitors in transistor amplifier	2.5	CO2, CO3
13	Amplifier with negative feedback., Principle of negative feedback amplifier, Gain of Negative voltage Feedback amplifier, Mathematical problems	2.5	CO2, CO3
14	Sinusoidal Oscillation, Types of sinusoidal oscillation, Oscillatory circuits	2.5	CO2, CO3
15	Colpitt's Oscillator, Hartley Oscillator, Mathematical problems	2.5	CO2, CO3
16	Introduction of OP-AMP, OP-AMP symbol, Polarity convention, Ideal OP-AMP characteristics, Virtual grounds and summing points, OP-AMP applications	2.5	CO1, CO2, CO3
	Total	**40**	

Mapping of Course Learning Outcomes to Program Learning Outcomes:

CO's/PO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2		✓										
CO3			✓									

Teaching Learning Activity:

TLA	Activity
TLA1	Active discussion in class to enhance students' understanding of electrical circuits.
TLA2	Group discussion to develop problem-solving skills and reinforce understanding of circuit principles.
TLA3	Aims to provide hands-on experience to students in building and analyzing basic electrical circuits.

Mapping Course Learning Outcome (COs) with the Teaching-Learning and Assessment Strategy:

COs	POs	Teaching Learning Activity	Assessment Strategy	Learning Domains	Knowledge Profile (WK)	Complex Engineering Problem (EP)	Complex Engineering Activity (EA)
CO1	PO1	TLA1	Midterm Final	C1, P1, P2, P3	K3	EP1	
CO2	PO2	TLA2	Midterm Final	C2, C3, P1, P2, A2	K3, K4	EP2	
CO3	PO3	TLA3	Midterm Final	C4, P1, P2, P3, P4, A1, A2	K3, K4	EP3	

Course Delivery Plan/Lesson Delivery Plan:

Week/Lesson (hour)	Discussion Topic and Book Reference	Student Activities during Online and Onsite [course teacher will decide based on the type of the contents]	Mapping with CO and PO	Assessment Plan
Week-1 Lesson 1 & 2 [2.5 Hours]	**Lesson 1:** Semiconductor, Bonds in Semiconductors, Commonly used Semiconductors, Energy Band Description, Effect of Temperature, Intrinsic and Extrinsic	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture	CO1 PO1	Class Test, Assignment, Midterm

	Semiconductor (Ref. V. K. Mehta, Chap-5, Pages: 55-62)	note, Open discussion.		
	Lesson 2: N-type and P-type semiconductor, majority and minority carrier, PN junction, properties of pn junction (Ref. V. K. Mehta, Chap-5, Pages: 62-67)			
Week-2 Lesson 3 & 4 [2.5 Hours]	**Lesson 3:** Biasing a pn junction, volt-ampere characteristics of pn junction, important terms, limitation in the operation of pn junction (Ref. V. K. Mehta, Chap-5, Pages: 67-73 and Video 1)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO1 PO1 CO2 PO2	Class Test, Assignment, Midterm
	Lesson 4: Semiconductor diode, Crystal diode as a rectifier, resistance of crystal diodes, Equivalent circuit of crystal diode, half wave rectifier, output frequency and efficiency of half wave rectifier, mathematical problems. (Ref. V. K. Mehta, Chap-6, Pages: 76-80, 87-91)			
Week-3 Lesson 5 & 6 [2.5 Hours]	**Lesson 5:** Full wave rectifier, Centre-tap full wave rectifier, Full wave bridge rectifier, output frequency and efficiency of full wave rectifier, mathematical problems. (Ref. V. K. Mehta, Chap-6, Pages: 91-98, Slide 1)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO1 PO1 CO2 PO2 CO3 PO3	Class Test, Assignment, Midterm

	Lesson 6: Mathematical problems, ripple factor, comparison of rectifier circuits, Clipper & clamper circuit, Filter circuits, types of filter circuits (Ref. V. K. Mehta, Chap-6, Pages:101-102, 103-105)			
Week-4 Lesson 7 & 8 [2.5 Hours]	**Lesson 7:** Voltage stabilization, Zener diode, Equivalent circuit, Zener diode as a voltage stabilizer **Lesson 8:** Mathematical problems Quiz 1	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Midterm
Week-5 Lesson 9 & 10 [2.5 Hours]	**Lesson 9:** Transistor, naming of transistor terminals, important facts about transistor **Lesson 10:** transistor action, transistor symbol, transistor as an amplifier, mathematical problems (Ref. V. K. Mehta, Chap-8, Pages: 141-147)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Midterm
Week-6 Lesson 11 & 12 [2.5 Hours]	**Lesson 11:** Problem solving and review class **Lesson 12:** Transistor connection, common base connection Quiz 2	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO-3	Class Test, Assignment, Midterm
	Lesson 13: Mathematical problems, V-I	Brainstorming sessions,		

Week-7 Lesson 13 & 14 [2.5 Hours]	characteristics of CB connection (Ref. V. K. Mehta, Chap-8, Pages: 148-152) **Lesson 14:** Common Emitter connection, V-I characteristics of CE connection	Classroom discussion, Voice over PPT, Lecture video, Lecture Note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Midterm
Week-8 Lesson 15 & 16 [2.5 Hours]	**Lesson 15:** Mathematical problems, **Lesson 16:** Common collector connection, V-I characteristics of CC connection, comparison of transistor connection (Ref. V. K. Mehta, Chap-8, Pages: 162-163)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Midterm
Midterm Examination **Syllabus: Week 1 – Week 8**				
Week-9 Lesson 17 & 18 [2.5 Hours]	**Lesson 17:** Field Effect Transistors (FET), Types of FET, JEFT, Principle and Working of JFET, Schematic symbol of JFET, Importance of JFET, Difference between BJT and JFET, Output Characteristics of JFET **Lesson 18:** Important Terms, Expression for Drain Current (ID), Mathematical problems, Advantages of JFET	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Presentation, Final

Week-10 Lesson 19 & 20 [2.5 Hours]	**Lesson 19:** MOSFET, Types of MOSFETs, Symbols for D-MOSFET, Circuit Operation of D-MOSFET, D-MOSFET Transfer Characteristic **Lesson 20:** D-MOSFETs Versus JFETs, E-MOSFET, D-MOSFETs Versus E-MOSFETs	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Presentation, Final
Week-11 Lesson 21 & 22 [2.5 Hours]	**Lesson 21:** Faithful amplification, Transistor biasing, Methods of transistor biasing, Base resistor methods, Voltage divider biased methods **Lesson 22:** Mathematical problems	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2 CO3 PO3	Class Test, Assignment, Presentation, Final
Week-12 Lesson 23 & 24 [2.5 Hours]	**Lesson 23:** Single stage Transistor Amplifier, Practical circuit of transistor amplifier (Ref. V. K. Mehta, Chap-10, Pages: 240-243) **Lesson 24:** Multistage Transistor amplifier, Role of capacitors in transistor amplifier, Important Terms (Ref. V. K. Mehta, Chap-11, Pages: 280-285 Slide 2)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2	Class Test, Assignment, Presentation, Final

Week-13 Lesson 25 & 25 [2.5 Hours]	**Lesson 25:** Amplifier with negative feedback., Principle of negative feedback amplifier, Gain of Negative voltage Feedback amplifier, Mathematical problems (Ref. V. K. Mehta, Chap-13, Pages: 335-341)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2	Class Test, Assignment, Presentation, Final
	Lesson 26: Sinusoidal Oscillation, Types of sinusoidal oscillation, Oscillatory circuits			
Week-14 Lesson 27 & 28 [2.5 Hours]	**Lesson 27:** Colpitt's Oscillator, Mathematical problems (Ref. V. K. Mehta, Chap-14, Pages: 372-374)	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2	Class Test, Assignment, Presentation, Final
	Lesson 28: Hartley Oscillator, Mathematical problems (Ref. V. K. Mehta, Chap-14, Pages: 374-376 Slide 3)			
	Quiz 3			
Week-15 Lesson 29 & 30 [2.5 Hours]	**Lesson 29:** Introduction of OP-AMP, OP-AMP symbol, Polarity convention, Ideal OP-AMP characteristics, Virtual grounds and summing points, OP-AMP applications **(Ref. Boylestad, Chap-14, Pages: 609-609 and BL Thereja, Chap-31, Pages: 497-500, Slide 4)**	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	CO2 PO2	Class Test, Assignment, Presentation, Final
	Lesson 30: Presentation on Project Work, Day-2			
Week-16	**Lesson 31:** Review Class – 1: for preparing for the final exam	Brainstorming sessions, Classroom	CO2	Class Test, Assignment,

Lesson 31 & 32 [2.5 Hours]	**Lesson 32:** Review Class – 2: for preparing for the final exam	discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	PO2	Presentation, Final
Final Examination **Syllabus: Week 10 – Week 16**				

Assessment Pattern:

Assessment Task	CO's			Marks (Total=100)
	CO1	CO2	CO3	
Attendance	--	--	--	7
Class Test	--	--	--	15
Assignment	--	--	--	5
Presentation	--	--	--	8
Midterm Examination	5	10	10	25
Final Examination	10	10	20	40
Total Marks	10	20	35	100

CIE – Breakup [60 marks]

Bloom's Criteria	**Attendance (07)**	**Class Test (15)**	**Assignment (05)**	**Presentation (08)**	**Mid Exam (25)**
Remember					
Understand		05	02	02	5
Apply		05		03	10
Analyze		05	03	03	10
Evaluate					
Create					

SEE – Semester End Examination [40 marks]

Bloom Criteria	**Score for the Test**
Remember	
Understand	10
Apply	10
Analyze	20

Assessment Scheme for Assignment (5)

Assessment Criteria	Assigned Marks	Assessment Rubrics
Understanding of Concepts	1	● Demonstrates a clear understanding of basic electrical circuit theory concepts. ● Accurately identifies and explains fundamental principles, laws, and components related to circuits.
Problem-Solving Skills	2	● Applies the learned concepts to solve circuit problems effectively. ● Demonstrates well-structured and logical solutions. ● Performs calculations accurately, without significant errors. ● Provide precise measurements and units where necessary.
Organization and Presentation	1	● Presents the assignment in a well-structured manner, with a clear layout and formatting. ● Uses appropriate headings, subheadings, and diagrams where applicable.
Clarity and Conciseness	1	● Expresses ideas and explanations clearly and concisely. ● Avoids ambiguity and unnecessary elaboration, making it easy to understand the solution.
Total	5	

Learning Materials:

Textbook/Recommended Readings:

1. Principles of Electronics: V. K. Mehta
2. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky

Reference Books/Supplementary Readings:

1. Microelectronic Circuits

   Adel S. Sedra and Kenneth C. Smith
2. Electrical Technology: Electrical Devices and Circuits

   B. L. Theraja and A.K. Theraja.

Other Readings: PowerPoint Lecture Slide Prepared by course teacher.